

IONS OR MOLECULES? POLYMER GELS CAN TELL

A disposable diaper is an item that doesn't seem to get a lot of respect. It gets sat upon, soiled, and tossed in the garbage, all in the space of a few hours. But have you ever stopped to think what a marvelous item it is? It is able to absorb and contain large amounts of liquid, and hold that moisture away from a baby's sensitive skin, while still being thin enough to allow a baby free movement while crawling and walking. How is it able to do that? Many disposable diapers contain superabsorbent polymers. These polymers are able to absorb more than 100 times their weight in water. Some are based on the cross-linking of polyacrylic acid. The acrylic acid monomer, or unit, is repeated over and over again in the polymer. Different strands of the polymer then cross-link to each other, creating a network (see my drawing on board). Water can then diffuse into this network.

Objective:

In this activity, you will use a superabsorbent polymer to investigate the effect of different solid compounds on the hydrated polymer. From your results, you should be able to classify the compounds.

Materials:

Sodium polyacrylate powder

Plastic cup

Measuring spoon or spatula

Distilled water

Piece of wax paper at least 30 cm on a side

6 of the following compounds:

All 3 of these:

Sand (SiO_2)

Sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$)

Splenda ($\text{C}_{12}\text{H}_{19}\text{C}_3\text{O}_8$)

And 3 of the following:

Salt (NaCl)

Epsom salt ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$)

Alum ($\text{KAl}(\text{SO}_4)_2$)

Washing soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$)

Procedure:

1. Obtain a teaspoon (5 ml by volume) of sodium polyacrylate powder from your instructor. Place into a plastic cup.
2. Add 40ml distilled water to the powder. Stir with a spoon or stirring rod. Observe and record the appearance of the mixture.
3. Repeat step 2 with a second and third 40ml portion of distilled water.

4. Scoop the resulting mixture onto a piece of wax paper that is at least 30 cm on each side. Divide the mixture into six equally sized piles. Move the piles so that they are at least 8-10cm away from each other and from the edges of the paper.
5. Choose six compounds that you wish to investigate from the list of compounds above.
6. Obtain your six choices one at a time. Sprinkle ~1/2 teaspoon of the chosen solid compound over the surface of one of the piles you created in step 4. Observe and record what happens to the pile in the data table. Repeat for the remaining five compounds.
7. Discard of your materials by carefully sliding the wax paper into a garbage bag.

Data and observations:

1. Observations of hydrated polyacrylate from step 2:
2. Complete the data table from step 6 of your procedure:

Compound name	Compound formula	Effect on polyacrylate

3. Look at the effects of each compound on the polyacrylate, and compare to the compound's chemical formula. Do you see any relationships/patterns? Check your book or notes to help you.
4. List 3 chemistry-related things you learned from this lab (use proper terminology when necessary):